

REPORTS on the MARINE BIOLOGY of the SUDANESE RED SEA.—XX. ALGÆ
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(With 4 Text-figures.)

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IN the present volume (vol. xxxi.) of the Society's Journal (Zoology), pp. 76-80 (1908), and reprinted in Vol. xxxviii. (1909), Botany, pp. 441-445, a brief account was given by one of us (R. J. H.-G.) of a small collection of Marine Algæ made by Mr. C. Crossland in the years 1904 and 1905, while making investigations on the Marine Fauna of the Sudanese Coast. That collection included 35 species equally divided between Chlorophyceæ, Phæophyceæ, and Rhodophyceæ. In 1910, Mr. Crossland forwarded another small collection of Marine Algæ from the same region (chiefly from Khor Dongonab), but pressure of other work has prevented any detailed examination of the material until the present year (1912). This second collection includes 48 species (apart from varieties and forms), 36 of which are additions to the previous list. Four of these 36 are Cyanophyceæ, 10 are Chlorophyceæ, 8 are Phæophyceæ, and 14 are Rhodophyceæ.

The chief memoirs consulted have already been recorded in the paper above mentioned, and need not be repeated here; but we have had occasion to refer also to two important monographs by Mr. A. Gepp and Mrs. E. S. Gepp, viz. :—“Marine Algæ (Chlorophyceæ and Phæophyceæ),” and “Marine Phanerogams of the ‘Sealark’ Expedition,” Trans. Linn. Soc. ser. 2 (Bot.), vol. vii. pt. 10; and “The Codiaceæ of the Siboga Expedition,” Mono. lxii.

We have also to express our thanks to Mr. Gepp for kindly identifying one of the Phæophyceæ which we had difficulty in determining.

(Species not present in the previous collection are indicated by an asterisk.)

CYANOPHYCEÆ.

- *1. SPHÆROZYGA CARMICHAELI, *Harv.*
- *2. LYNGBYA SEMIPLANA (*Ag.*), *J. Ag.*
- *3. CALOTHRIX PARASITICA (*Chavv.*), *Thur.*
- *4. DERMOCARPA PRASINA (*Reinsch.*), *Born.*

CHLOROPHYCEÆ.

- *5. HALIMEDA TUNA, *Lamour.*, f. TYPICA, *Bart.*
 *6. HALIMEDA OPUNTIA, *Lamour.*, f. TYPICA, *Bart.*
 " " " f. TRILOBA, *Bart.*
 * " " " f. CORDATA, *Bart.*
 7. CODIUM TOMENTOSUM, *Kütz.*
 *8. CODIUM TENUE, *Kütz.*
 9. AVRAINVILLEA LACERATA, *J. Ag.*, f. TYPICA, *Bart.*
 " " " f. ROBUSTIOR, *Bart.*
 *10. CAULERPA FREYCINETII, *J. Ag.*, var. DE BORYANA, *Van Bosse.*
 *11. CAULERPA CUPRESSOIDES, *J. Ag.*, var. LYCOPODIUM, *Van Bosse.*
 *12. CAULERPA SCALPELLIFORMIS, *R. Br.*
 13. CAULERPA RACEMOSA, *J. Ag.*, var. UVIFERA, *J. Ag.*
 14. UDOTEA ARGENTEA, *Zan.*, f. TYPICA, *Bart.*
 *15. FLABELLARIA MINIMA, *Gepp.*
 *16. BRYOPSIS IMPLEXA, *De Not.*
 " " " var. ELEGANS, *Hauck.*
 *17. CHÆTOMORPHA LINUM, *Kütz.*
 *18. VALONIA ÆGAGROPILA, *J. Ag.*
 19. DICTYOSPHERIA FAVULOSA, *Decne.*

PHÆOPHYCEÆ.

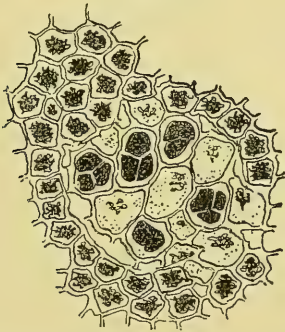
20. SARGASSUM SUBREPANDUM, *J. Ag.*
 21. SARGASSUM DENTIFOLIUM, *J. Ag.*
 *22. SARGASSUM LINIFOLIUM, *J. Ag.*
 *23. CYSTOSEIRA AMENTACEA, *Bory.*
 *24. TURBINARIA DECURRENS, *Bory.*
 *25. ZANARDINIA COLLARIS, *Crouan.*
 26. PADINA PAVONIA, *J. Ag.*
 *27. ZONARIA VARIEGATA, *Mart.*
 28. HYDROCLATHRUS CANCELLATUS, *Bory.*
 *29. HYDROCLATHRUS SINUOSUS, *Zan.*
 *30. DICTYOTA DICHOTOMA, *J. Ag.*, var. IMPLEXA, *Hauck.*
 *31. SPHACELARIA CIRRHOSA, *J. Ag.*, var. MINIMA, *Zan.*

RHODOPHYCEÆ.

32. SPYRIDIA FILAMENTOSA, *J. Ag.* (With cystocarpia and antheridia.)
 *33. GELIDIUM CRINALE, *Thur.*
 *34. LIAGORA VISCIDA, *Ag.* (With cystocarpia and antheridia.)
 *35. DIGENEA SIMPLEX, *Ag.*
 *36. GALAXAURA ADRIATICA, *Zan.*

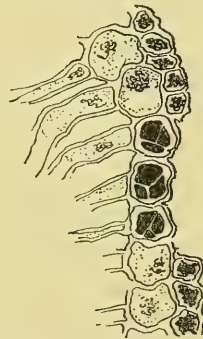
Hauck ('Die Meeresalgen Deutschlands und Oesterreichs') states that antheridia and tetragonidia (tetrasporangia) are unknown in the genus. Only one plant of this species was present in the collection, but it was of special interest inasmuch that it bore both cystocarpia and tetragonidia. The gonidia are developed on the terminal branches, and on surface view appear at the base of shallow depressions in the thallus. The main body of the thallus consists of loosely woven hyphæ passing over into shorter cells lying at right-angles to the surface. The exterior ends of these cells abut on a subepidermal layer of large cells, covered in turn by a compact external layer of rather smaller cells, which present a mosaic on surface view. The superficial cells

Fig. 1.



Surface view of the tetragonidial region.
 × 450.

Fig. 2.



Tetragonidial region in section.
 × 450.

are strongly calcified. The tetragonidia are formed in the subepidermal layer, and the mother-cell contents divide in the tetrahedral manner into the four tetragonidia. As the gonidia mature the superficial cell-layer disappears, forming the shallow depression seen on surface view (figs. 1, 2). Cystocarpia are formed in the same branch and at the bottom of similar depressions.

While investigating the Marine Algæ of the Isle of Man, we have been struck with the frequency with which we have met with sexual and asexual organs, not merely on the same plant but on the same branch. This phenomenon we have observed in *Lophothalia byssoides*, *Callithamnion Hookeri*, *Callithamnion tetragonum*, *Callithamnion corymbosum*, and

Polysiphonia violacea. Indeed, we have been forced to the opinion that the joint occurrence of sexual and asexual cells on the same plant is by no means an exceptional phenomenon, and Mr. A. D. Cotton informs us that he has noticed the same joint occurrence in *Laurencia hybrida* and *Callithamnion* sp. In his paper on *Polysiphonia violacea* (Bot. Gaz. vol. xlii. 1906, p. 401), Yamanouchi demonstrates, in that species, a regular alternation of generation between a gametophyte with 20 chromosomes and a sporophyte with 40 chromosomes. At the same time, he records under the head of "Abnormalities," the occurrence of tetragonidia on cystocarpic or antheridial plants, and refers to similar cases noted by Lotsy in *Chylocladia kaliformis*, and by Davis in *Spermothamnion Turneri* and *Callithamnion Baileyi*. He adds, "Such cases should be carefully investigated to determine whether true tetraspores are present or whether the structures are not really of the nature of monospores, as in *Polysiphonia*, and developed with a suppression of reduction phenomena." In the plants of *Polysiphonia violacea* collected by us in 1912 at Port Erin, Isle of Man, cystocarpia and gonidangia were frequently present on the same branch, and the number of cases we met with, both in that species and in other genera, in our opinion, scarcely justifies the view that all of these are to be regarded as abnormalities. One of us is at present engaged on a detailed investigation of the matter from the cytological point of view, the results of which it is hoped to publish shortly. (See note, p. 405.)

*37. LOMENTARIA SQUARROSA, *Kütz.*

38. HYPNÆA VALENTIÆ, *J. Ag.* (With cystocarpia and tetragonidia.)

In this plant also we found both sexual and asexual reproductive organs in the same individual, indeed all the specimens were covered with "fruit" of both types. The cystocarpia are of the normal *Hypnæa* type. The tetragonidia divide in a zonate manner and are formed abundantly from the superficial cells of ovoid pointed stichidia (fig. 3). The specimens were also interesting as exhibiting "Brutknospen," or vegetative buds, closely resembling those of *Sphacelaria*. The adult form of these buds is stellate (fig. 4 *a, b, c, d*), but all stages in their development could be readily traced on the same plant.

*39. LAURENCIA OBTUSA, *Lamour.* (With cystocarpia and antheridia.)

40. LAURENCIA PAPILLOSA, *Grev.* (With cystocarpia.)

*41. DUDRESNAYA COCCINEA, *Crouan.* (With cystocarpia and antheridia.)

*42. POLYSIPHONIA UTRICULARIS, *Zan.*

*43. MELOBESIA THURETHI, *Born.* (On *Jania rubens*, with cystocarpia.)

*44. LITHOTHAMNION POLYMORPHUM, *Aresch.*

*45. LITHOTHAMNION FASCICULATUM, *Aresch.*

- *46. LITHOPHYLLUM EXPANSUM, *Phil.*
- *47. LITHOPHYLLUM CRISPATUM, *Hauck.*
- *48. JANIA RUBENS, *Lamour.*



The collection also included fragments of Marine Phanerogams, more especially *Salicornia fruticosa*, Linn., *Cymodocea nodosa*, Asch., and *Halophila stipulacea*, Asch.

[Since writing the above paper we have noticed an article in the Bot. Gazette, Aug. 1912, by G. B. Rigg and A. D. Dalgity, in which similar phenomena are discussed in connection with another species of *Polysiphonia*, viz., *Polysiphonia bipinnata*. The authors indicate their intention of continuing the study of this plant from a cytological point of view. We still intend, however, to continue the research indicated above, as it may be of interest to compare the cytological conditions underlying this phenomenon in plants gathered from both western and eastern shores of the Atlantic.—R. J. H.-G. & M. K., 7th January, 1913.]